AMENDMENT OF CLAIMS

Claim 1. (currently amended)

A method of calibrating a gyro of a spacecraft comprising:

determining a yaw attitude residual from a first yaw attitude measured by attitude sensors <u>including a sun sensor to determine absolute yaw attitude of the spacecraft when the sun comes in a field of view of the sun sensor,</u> and <u>subtracting from the measured first yaw attitude</u> a second yaw attitude estimated by gyro compassing <u>when the sun is not in a field of view of the sun sensor;</u>

~~determining~~ <u>converting the difference yaw attitude residual into</u> a roll gyro bias residual ~~using said yaw attitude residual~~; and

calibrating the gyro in response to said <u>converted</u> roll gyro bias residual.

Claim 2. (canceled)

Claim 3. (currently amended)

The method as in claim 1 further comprising adjusting <u>an</u> update gain of said roll gyro bias residual in response to a thermal model estimation.

Claim 4. (currently amended)

The method as in claim 3 wherein adjusting <u>an</u> update gain of said roll gyro bias residual comprises determining said update gain via a Kalman filter.

Claim 5. (previously presented)

The method as in claim 1 further comprising calibrating the gyro at a first periodic rate during an initialization period and calibrating the gyro at a second periodic rate upon expiration of said initialization period.

Claim 6. (previously presented)

The method as in claim 1 further comprising summing said roll gyro bias residual with a previous roll gyro bias estimation to generate a current roll gyro bias estimation.

Claim 7. (previously presented)

The method as in claim 1 wherein calibrating the gyro is implemented via on-board flight software.

Claim 8. (withdrawn from consideration)

A method as in claim 1 wherein calibrating the gyro is implemented via ground based operational software.

Claim 9. (previously presented)

The method as in claim 1 wherein calibrating the gyro is performed approximately once per orbit and near a beginning portion of a gyro calibration period.

Claim 10. (previously presented)

The method as in claim 1 wherein calibrating the gyro is performed using at least one yaw attitude signal sample per orbit near a beginning portion of a gyro calibration period.

Claim 11. (currently amended)

The method as in claim 1 wherein said yaw attitude residual is determined ~~using~~ by measuring a plurality of second yaw attitude signal samples per orbit near a beginning portion of a gyro calibration period.

Claim 12. (currently amended)

The method as in claim 11 further comprising using a weighted averaging of said plurality of second yaw attitude signal samples.

Claim 13. (currently amended)

A method of reorienting a spacecraft comprising:

determining a first yaw attitude of the spacecraft by attitude sensors measurements including a sun sensor to determine absolute yaw attitude of the spacecraft when the sun is in a field of view of the sun sensor;

determining a second yaw attitude of the spacecraft by gyro compassing when the sun is not in a field of view of the sun sensor;

determining a yaw attitude residual using the difference between said first yaw attitude and said second yaw attitude;

determining a roll gyro bias residual using said difference yaw attitude residual;

calibrating ~~said~~ a roll gyro using said determined roll gyro bias residual;

estimating attitude of the spacecraft using said calibrated roll gyro; and

reorienting the spacecraft in response to said estimated attitude.

Claim 14. (withdrawn from consideration)

A gyro calibration system for a spacecraft comprising an attitude estimator determining a roll gyro bias residual in response to a yaw attitude residual and calibrating the gyro in response to said roll gyro bias residual.

Claim 15. (withdrawn from consideration)

A system as in claim 14 further comprising: a reference sensor generating a first yaw attitude signal; a gyro generating a second yaw attitude signal; and said attitude estimator determining yaw attitude residual in response to said first yaw attitude signal and said second yaw attitude signal.

Claim 16. (withdrawn from consideration)

A system as in claim 15 wherein said reference sensor is a sun sensor.

Claim 17. (withdrawn from consideration)

A system as in claim 14 wherein said attitude estimator is at least partially part of the spacecraft flight software.

Claim 18. (withdrawn from consideration)

A system as in claim 14 wherein said attitude estimator is at least partially part of a ground operation software.

Claim 19. (withdrawn from consideration)

A system as in claim 14 further comprising a filter filtering said first yaw attitude signal.

Claim 20. (withdrawn from consideration)

A system as in claim 14 wherein said attitude estimator adjusts update gain of said roll gyro bias residual in response to a thermal model prediction.

Claim 21. (withdrawn from consideration)

A system as in claim 20 wherein said attitude estimator adjusts update gain of said roll gyro bias residual via a Kalman filter.

Claim 22. (withdrawn from consideration)

A spacecraft reorientation system comprising:

a reference sensor generating a first yaw attitude signal;

a gyro-compassing generating a second yaw attitude signal;

an attitude estimator determining yaw attitude residual in response to said first yaw attitude signal and said second yaw attitude signal, determining roll gyro bias residual in response to said yaw attitude residual, and calibrating said roll gyro in response to said roll gyro bias residual;

said attitude estimator estimating attitude of the spacecraft at least in part in response to spacecraft attitude determined by said calibrated roll gyro; and

a controller reorienting the spacecraft in response to said estimated attitude and a desired attitude.

Claim 23. (currently amended)

A method of calibrating a gyro of a spacecraft comprising:

determining attitude of the spacecraft measured during a yaw transient period ~~using sensor attitude measurements~~ by disabling yaw gyro calibration during the yaw transient period and:

determining a first yaw attitude of the spacecraft by attitude sensors measurements including a sun sensor to determine absolute yaw attitude of the spacecraft when the sun is in a field of view of the sun sensor;

determining a second yaw attitude of the spacecraft by gyro compassing when the sun is not in a field of view of the sun sensor;

determining a yaw attitude residual using the difference between said first yaw attitude and said second yaw attitude;

determining a roll gyro bias residual using said difference yaw attitude residual;

calibrating a roll gyro using said determined roll gyro bias residual;

estimating attitude of the spacecraft using said calibrated roll gyro; and

gain scheduling gyro calibration and attitude determination using at least partially said spacecraft attitude ~~measured~~ determined during the yaw transient period.

Claim 24. (previously presented)

The method as in claim 23 wherein gain scheduling comprises using a gain scheduling signal during the yaw transient period.

Claim 25. (previously presented)

The method as in claim 24 wherein using a gain scheduling signal comprises using a yaw transient error.

Claim 26. (withdrawn from consideration)

A method as in claim 24 wherein using a gain scheduling signal comprises using a sun sensor measurement.

Claim 27. (withdrawn from consideration)

A method as in claim 24 wherein using a gain scheduling signal comprises using ephemeris.

Claim 28. (previously presented)

The method as in claim 23 wherein gain scheduling comprises disabling said gyro calibration for at least one attitude axis during an initial period when the sun comes within a field of view of an associated sun sensor.

Claim 29. (previously presented)

The method as in claim 23 wherein gain scheduling comprises disabling said gyro calibration for at least one attitude axis during a period when a yaw attitude error is greater than a predetermined value.

Claim 30. (previously presented)

The method as in claim 23 wherein gain scheduling comprises disabling said gyro calibration for at least one attitude axis during said yaw transient period.

Claim 31. (withdrawn from consideration)

A method as in claim 23 wherein performing gain scheduling comprises varying gyro bias update gain for at least one attitude axis from low to nominal during said yaw transient period.

Claim 32. (withdrawn from consideration)

A method as in claim 23 wherein performing gain scheduling comprises varying attitude update gain of at least one attitude axis from high to nominal during said yaw transient period.

Claim 33. (withdrawn from consideration)

A method as in claim 23 wherein gain scheduling comprises resetting attitude covariance of at least one axis to a high value.

Claim 34. (withdrawn from consideration)

A method as in claim 23 wherein gain scheduling comprises resetting gyro covariance of at least one axis to a low value.

Claim 35. (withdrawn from consideration)

A gyro calibration system for a spacecraft comprising an attitude estimator gain scheduling gyro calibration and attitude determination for a yaw transient period.

Claim 36. (withdrawn from consideration)

A system as in claim 35 wherein said attitude estimator in gain scheduling gyro calibration and attitude determination disables gyro calibration for at least one

attitude axis during said yaw transient period.

Claim 37. (withdrawn from consideration)

A system as in claim 35 wherein said attitude estimator in gain scheduling gyro calibration and attitude determination varies attitude update gain of at least one attitude axis from high to nominal during said yaw transient period.

Claim 38. (withdrawn from consideration)

A system as in claim 35 wherein said attitude estimator in gain scheduling gyro calibration and attitude determination resets attitude covariance of at least one attitude axis to a high value during said yaw transient period.

Claim 39. (withdrawn from consideration)

A system as in claim 35 wherein said attitude estimator in gain scheduling gyro calibration and attitude determination varies gyro bias update gain of at least one attitude axis from low to nominal during said yaw transient period.

Claim 40. (withdrawn from consideration)

A system as in claim 35 wherein said attitude estimator in gain scheduling gyro calibration and attitude determination resets gyro bias covariance of at least one attitude axis to a low value during said yaw transient period.